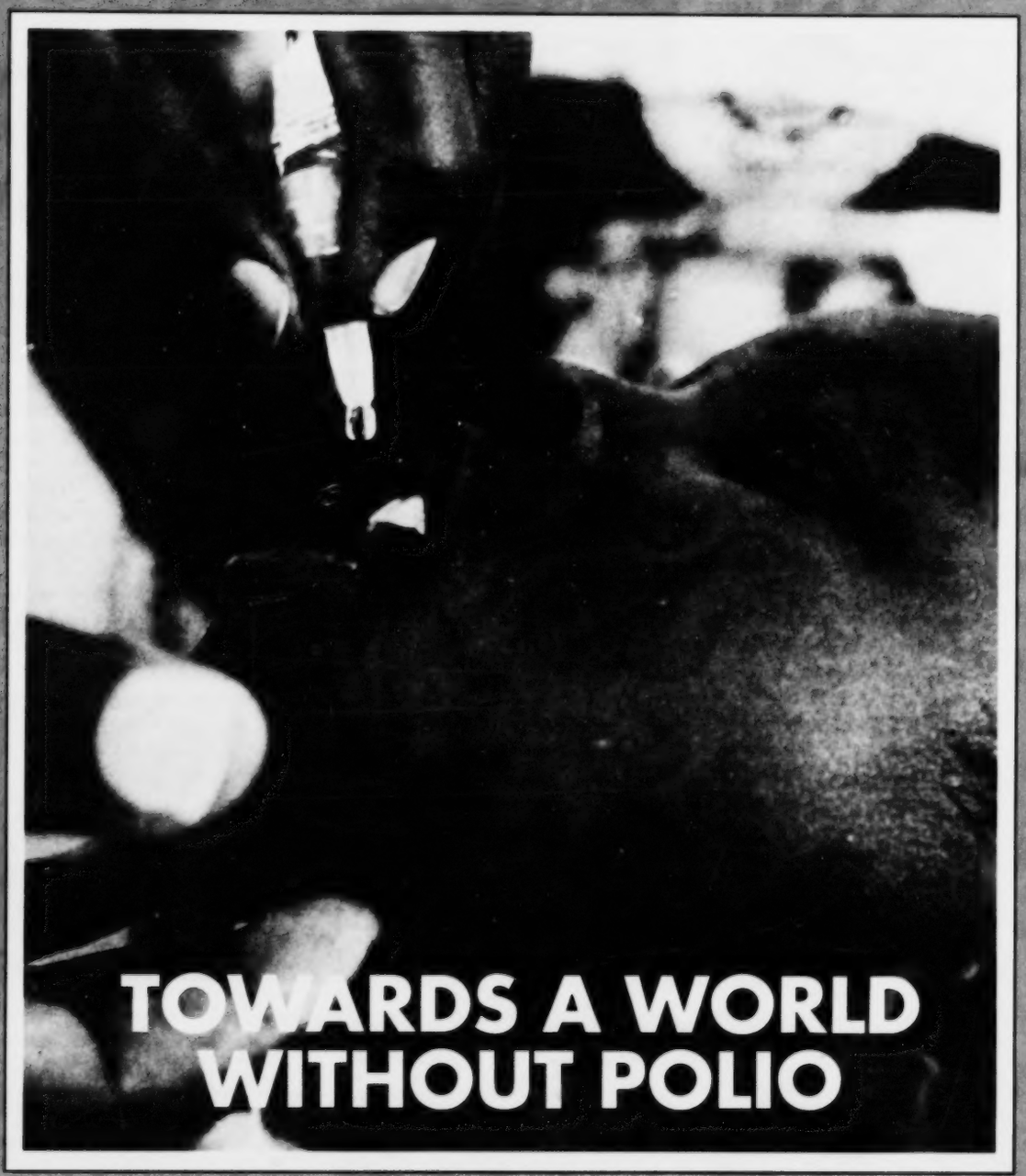
WORLD HEALTH

THE MAGAZINE OF THE WORLD HEALTH ORGANIZATION

48TH YEAR, NO. 1, JANUARY–FEBRUARY 1995



TOWARDS A WORLD WITHOUT POLIO

WORLD HEALTH
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World Health ■ 48th Year, No. 1, January–February 1995
IX ISSN 0043-8502

Correspondence should be addressed to the Editor, World Health Magazine, World Health Organization, CH-1211 Geneva 27, Switzerland, or directly to authors, whose addresses are given at the end of each article.
For subscriptions see order form on page 31.

World Health is the official illustrated magazine of the World Health Organization. It appears six times a year in English, French, Russian and Spanish, and four times a year in Arabic and Farsi. The Arabic edition is available from WHO's Regional Office for the Eastern Mediterranean, P.O. Box 1517, Alexandria 21511, Egypt. The Farsi edition is obtainable from the Public Health Committee, Iran University Press, 85 Park Avenue, Teheran 15875-4748, Iran. The Russian edition can be obtained from "Meditsina" Publishing House, Petroverigski per., 6/8, 101000 Moscow, Russian Federation.

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Editorial

World Health Day 1995
Target 2000 – A world without polio

Hiroshi Nakajima

The world now stands on the brink of global eradication of poliomyelitis.

Since Jonas Salk in 1955, followed by Albert Sabin in 1961, produced and demonstrated the effectiveness of their vaccines against polio, and especially since WHO and UNICEF's Expanded Programme on Immunization brought potent, well-stored, safely administered polio vaccines to over 80% of the world's children, polio has been in retreat. In 1988, the World Health Assembly targeted global polio eradication for the year 2000, a fitting gift from health workers of this century to the children of the next.

On 29 September 1994, an International Commission headed by Dr Frederick Robbins was able to declare that the disease had been eradicated throughout the Region of the Americas, just ten years after the Directing Council of the Pan American Health Organization committed its Member States to the eradication target. All regions of the world are now making steady progress towards that goal.

The whole area of the Western Pacific is about to become the second polio-free region in the world. On World Health Day – 7 April 1995 – it is anticipated that at least 15 countries in Europe and the Eastern Mediterranean will provide polio vaccine to their children simultaneously.

Dr Hiroshi Nakajima, Director-General of the World Health Organization.

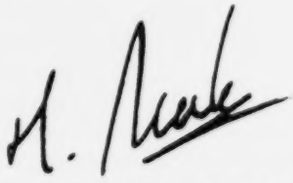
The key to success is the application of certain simple and highly effective strategies. National immunization days, during which vaccine is given within a day or two to all children under five, supplement routine immunizations. Systems of surveillance, which include testing faecal samples for the poliovirus, identify and investigate all cases of flaccid paralysis in children. As fewer and fewer cases occur, wide-spread house to house immunization finally reduces transmission to zero, thus leading to eradication.

Many partners are working towards this common goal. While almost 80% of resources needed for success will come from the endemic countries themselves, many agencies and institutions besides WHO, notably Rotary International, UNICEF, the US Centers for Disease Control and Prevention, and the International Development Banks, as well as the governments of Canada, Japan and the United States, are cooperating to ensure that critical needs for advocacy, support and vaccine are being met.

Before we can sit back and enjoy the benefits of polio eradication, however, the job has to be completed. There is a need for national immunization days to be organized, for sustainable supplies of good quality vaccine to be stocked and delivered, for personnel to be trained, and for epidemiological surveillance to be established.

But the task is not confined exclusively to public health services. Only by joining forces with governmental and nongovernmental organizations, United Nations agencies, and the public at large can the target be met on time. Everyone involved in the polio eradication initiative should be proud of the fact that his or her local efforts are making possible the realization of the global goal. *TARGET 2000* can only be achieved by ensuring that village after village, district after district, country after country is polio-free.

The eradication of polio is within our grasp. We owe it to future generations not to let it slip away. ■



Hiroshi Nakajima, M.D., Ph.D.

WHO's new vaccines programme

Jong-Wook Lee

chance to grow up in good health.

WHO's new Global Programme on Vaccines and Immunization intends to use polio eradication as a leading wedge to implement effective, surveillance-based approaches to neonatal tetanus elimination and measles control.

WHO has embarked on a new phase in its task of protecting the health of children around the world. An improved, integrated approach to immunization is needed if the world's children are to grow up healthy. In turn, there is a need to change the philosophy from a simplistic approach – all children have a right to be immunized – to a broader one: all children must be protected from death and disability by making the best vaccines available and using them in the most effective manner. To meet these needs, WHO has created a new Global Programme on Vaccines and Immunization (GPV).

Twenty years ago, when the Expanded Programme on Immunization (EPI) was founded, fewer than 5% of children born each year were immunized. In the last two decades, immunization programmes have been established in every country of the world. WHO estimates that more than 75% of infants born in 1993 were fully immunized and 45% of pregnant women were immunized to protect their infants against neonatal tetanus. With current levels of immunization, EPI prevents an estimated 2 900 000 deaths from measles, neonatal tetanus and whooping cough and 560 000 cases of poliomyelitis each year.

Pitfalls ahead

This is a remarkable achievement. What then are the problems that demand a new approach to immunization? Firstly, instead of rising to 90% as planned, immunization coverage is now falling. In addition, there are at least 18 countries where immunization coverage remains less than 50%. If we are to protect every child, we must redouble our efforts to increase coverage in countries which have extremely low coverage and stop the trend towards lower coverage in some successful countries.

Secondly, EPI has essentially been limited to the six antigens initially recommended by the programme. With some exceptions, we have failed to incorporate other, existing vaccines into the programme. Children in the developing world remain at risk for hepatitis B, rubella ("German measles") and in some countries yellow fever and infection with *Haemophilus influenzae*. Now that so many countries are doing so well, we must accelerate the introduction of additional vaccines into EPI programmes around the world.

Thirdly, poor quality vaccines have been used in some countries. All the effort involved in immunizing a child is wasted when there is no immunological response to the vaccine. If unsafe or impotent vaccines are used, parents lose faith and will no longer bring their children for immunization. We must, therefore, work with countries to ensure that only safe and effective vaccines are used in EPI programmes.

Fourthly, EPI's three disease control objectives have yet to be reached. WHO estimates that each

year 110 000 children are still being crippled by polio, 500 000 babies die from neonatal tetanus, and 1 200 000 children die from measles. Controlling these three diseases requires an epidemiological approach to disease, defining high-risk groups and targeting immunization to those most in need. As is clear from this issue of *World Health*, the global poliomyelitis eradication target for the year 2000 is the most advanced of the three objectives. All the evide indicates that this disease has beer eradicated from the Western Hem sphere, and rapid progress is being made towards the goal in the five WHO Regions where polio remai endemic. GPV is fully committed the polio eradication goal and inte to use polio as a leading wedge to implement effective, surveillance-based approaches to neonatal tetanus elimination and measles control.

Fifthly, global research and development of vaccines has primarily been driven by the market forces and scientific interests of the industrialized countries. If we are to achieve our goal of protecting the most vulnerable children, special efforts will be required to channel the development, testing and licensing process so that appropriate new and/or improved vaccines are available to immunization programmes in developing nations. WHO's leadership in developing a more thermostable oral polio vaccine, for example, will result in simplified logistics and lower costs for conducting mass campaigns. At the same time, the likelihood that a child will receive an impotent vaccine will be greatly reduced.

Three operational units

GPV will implement this new approach to immunization through its three operational units, the Expanded Programme on Immunization (EPI), Vaccine Supply and Quality (VSQ), and Vaccine Research and Development (VRD). EPI will define global immunization policies and provide technical support to countries, through the WHO Regional Offices. VSQ will work with countries, donors, and vaccine manufacturers to ensure that adequate quantities of vaccines are available to all national EPI programmes, and that only safe and fully potent vaccines are provided to those programmes. VRD will stimulate and support the research and development activities, which will lead both to new vaccines and to improved, existing vaccines and will provide the scientific basis for their optimum use.

I believe that the three sections of the new Global Programme for Vaccines and Immunization are in keeping with the ideal of the Children's Vaccine Initiative – to link all stages of the vaccine life-cycle from the bench to the bush. EPI, VSQ and VRD will work synergistically to link vaccine research, development, supply and delivery so as to accelerate our efforts to protect children from illness, disability and death. I anticipate that the most immediate effects will be the eradication of polio and dramatic improvements in the control of measles, neonatal tetanus and other EPI diseases. In addition, our capacity will be increased to prevent and control other diseases and bring us closer to WHO's ultimate goal of Health for All. ■

Dr Jong-Wook Lee is Director of the Global Programme for Vaccines and Immunization, World Health Organization, 1211 Geneva 27, Switzerland.

Target 2000

Nicholas Ward & Harry Hull

The goal: to immunize as many infants as possible.

When, in 1988, the World Health Assembly established the year 2000 as the target for global poliomyelitis eradication, a period of 12 years was allotted to accomplish that goal. As 1995 begins, more than half that time has elapsed and it is appropriate to examine the progress that has been achieved and what remains to be accomplished if we are to wipe out the naturally occurring or "wild" poliovirus within the next five years.

The strategies for polio eradication recommended by WHO are simple in concept. Firstly, to support routine immunization systems and immunize as many infants as possible with 3-4 doses of oral polio vaccine (OPV). High routine coverage reduces the incidence of polio to low levels and forms the base for the polio eradication initiative. Third-dose (OPV3) coverage rose rapidly during the 1980s, and WHO estimates that 80% of infants born in 1993 have been immunized with three doses of OPV.

The second polio eradication strategy is to conduct national immunization days. These campaigns administer two doses of OPV to all children under five, including those who have previously received the basic course of immunization. The object is to stop the spread of wild poliovirus by boosting the immunity of children who have already been vaccinated and by immunizing children not reached by routine services. As the virus cannot live for long periods outside the human body, national immunization days effectively remove the wild poliovirus from countries where the disease is endemic.

The third strategy is to establish extremely sensitive surveillance systems, capable of detecting every last case of poliomyelitis in a country. Because other paralytic conditions can mimic polio, stool specimens are collected from all children with acute flaccid paralysis. These stool specimens are then tested in certified laboratories to determine if the paralysis is caused by wild poliovirus.

The final strategy is to use surveillance data to plan and carry out localized immunization campaigns, targeting high-risk districts where the last few cases of polio occur. In these "mopping-up" campaigns, OPV is taken from door to door, and two doses are administered to all children under five.

Rapid decline in cases

As these strategies have been successfully undertaken by more and more countries, the number of cases is declining rapidly and the wild poliovirus is being confined to a geographically restricted area of the world. The number of cases reported in 1993 by WHO's Member States was only 9164. This is a 74% decline from the 35 225 cases reported to WHO in 1988.

Six "emerging polio-free zones" have been identified where the wild virus has either disappeared or is at such a low level that eradication could be rapidly achieved. These zones are: The Americas, Western and Central Europe, North Africa, the Middle East, Southern and East Africa, and the Western Pacific. West and Central Africa and South Asia are the principle reservoirs of wild poliovirus.

In the American Region, it is more than three years since the last case occurred in the entire Western Hemisphere, affecting a two-year-old boy from Peru who was paralysed in August 1991. The Region has been certified free of wild virus, but children are still being immunized to prevent any spread if the virus should be reintroduced from other continents.

Although much has been accomplished and there are many reasons to be confident that Target 2000 will be achieved, global polio eradication is far from assured. What are the major obstacles to be overcome if we are to reach the goal? First among these is insufficient political commitment.

The World Health Assembly established the polio eradication target in 1988 and reaffirmed that commitment in 1993. UNICEF and more than 130 world leaders adopted the same goal at the World Summit for Children in 1990. Yet sufficient support to achieve the goal is only beginning to materialize. Rotary International, in particular, is to be commended for its advocacy efforts on behalf of polio eradication. But if global eradication is to be achieved, all polio-endemic countries will need to make the commitment to eradication at the highest levels.

Since the benefits of polio eradication will accrue to all countries, additional financing for the initiative should be provided by both industrialized countries and the international donor agencies. Additional political commitment and expanded external funding will be particularly important as each year passes, for as the target approaches, wild poliovirus will exist only in the least vigilant countries and the most difficult regions within those countries.

Financing the initiative remains problematic. The most recent estimate of the total external cost of polio eradication is more than $800 million, nearly two-thirds of which is for the purchase of oral polio vaccine. If funds are available, current production capacity is sufficient to manufacture all the vaccine needed, but additional funds for vaccine purchase are still needed.

On National Immunization Day, every child receives the life-saving "polio drop"

Global immunization coverage peaked in 1990 when 85% of infants born that year had received three or more doses of OPV; since then there has been a gradual decline in immunization coverage for all vaccines. The combination of falling coverage and low disease incidence results in a rapidly increasing population of children who have not been vac-cinated but are also not immune through natural infection. Political upheavals, economic change, social unrest and war pose constant threats to the Polio Eradication Initiative.

If the world unites to provide the additional financial resources, personnel and vaccine needed, all these obstacles can and will be overcome. We can then look forward to the day when parents need no longer fear that their child will be crippled by poliomyelitis. ■

Dr Nicholas Ward and Dr Harry Hull are with the Expanded Programme on Immunization, Global Programme for Vaccines and Immunization, World Health Organization, 1211 Geneva 27, Switzerland.

Eradication approaching in China

The front lines of the global war against poliomyelitis have shifted from South America to Asia. The battle has been fierce in the world's most populous nation, China, but polio is now in full retreat, and there are high hopes that wild virus transmission will be stopped in time to meet China's 1995 eradication goal.

Thanks to the excellent primary health care system, polio seemed to be disappearing from China when the global eradication target was established. Widespread epidemics with some 5000 cases in both 1989 and 1990 dimmed hopes, but China has fought back. Provincial-level immunization days in 1991 and 1992 set the stage for the world's largest public health events – national immunization days held a year ago and currently being repeated this winter.

The result of these campaigns has been a rapid decline in the polio cases reported – only 653 in 1993. More revealing is evidence provided by laboratory-based virological surveillance. Wild poliovirus was found in seven out of 30 provinces in 1993 and in only one province during the first half of 1994. The seven provinces were targeted for final-stage immunizations last autumn.

Planning the final assault on polio requires accurate, timely knowledge about the last chains of virus transmission, obtainable only by culturing stool specimens from every paralysed child in the country. Virology laboratories in most provinces lack essential supplies and work with outdated equipment. A coalition of donors, led by Rotary International, Japan, the USA, Australia and UNICEF, is planning to upgrade Chinese virology laboratories to cope with the expanded workload. As one donor puts it: "If these improvements are not made soon, China could even face the possibility of having eradicated polio and not being able to prove it to a sceptical world."

A template for the world

Ciro A. de Quadros

The disappearance of poliomyelitis from the Americas since 1991 offers a foretaste of the benefits that mankind can expect from new and improved vaccines in the years to come.

A health centre in Costa Rica provides routine polio vaccination.

The challenge

In May 1985, the Director of the Pan American Health Organization (PAHO), WHO's Regional Office for the Americas, proposed that poliomyelitis be eradicated from the Western Hemisphere by 1990. At that time the Expanded Programme on Immunization (EPI) in the Americas had achieved a certain level of success, with coverage increases to around 60% for some vaccines in the programme, such as DPT, BCG and measles, and over 75% for poliomyelitis vaccine. This proposal, which was met by scepticism by many, was endorsed by the PAHO Directing Council in September of 1985 and was launched with objectives that aimed at the eradication of polio, as well as organizing surveillance systems and improving the overall immunization programme.

The strategy

The strategy was based on maintaining high immunization levels with oral poliomyelitis vaccine (OPV) in the target population of children under five years of age and establishing a surveillance system for detection of cases of acute flaccid paralysis (AFP) for subsequent investigation to determine whether they were due to wild poliovirus.

High immunization levels were maintained by holding national immunization days, usually twice a year one or two months apart, when all children under five years of age received a dose of OPV, regardless of their previous immunization status. This strategy had proved successful in several countries, starting with Cuba in 1962. Subsequently, "mop-up" operations or house-to-house vaccination campaigns with OPV were carried out in districts which were still at high risk of wild poliovirus circulation.

Over 20 000 health units were organized in a surveillance network for the weekly reporting of cases of AFP, and a cadre of health workers was trained in the epidemiological investigation of these cases. Two stool samples had to be collected and properly transported to one of a network of laboratories equipped with trained personnel and modern technologies for testing those samples to determine if they harboured wild poliovirus.

The results

In 1985, there were nearly 1000 cases of poliomyelitis reported in the Region of the Americas, compared with over 10 000 cases estimated to be occurring annually in the 1970s. By the end of 1990, only 18 cases were reported, and transmission was on the verge of being interrupted. Interruption was finally achieved in 1991, when only nine cases were identified: eight in Colombia until April, and one in Peru – a two-year-old boy named Jose Fermin, with date of onset 23 August – believed to be the last polio case in the Americas.

The obstacles

Among the major obstacles at the outset of the programme were the lack of political will and the limited resources available. The social norm that hitherto had accepted children being maimed every year by a virus that could be eradicated had to be changed. Intensive social mobilization that followed the initiative

brought about increased awareness among communities and their political leaders of the need to reach the goal.

Civil wars in some countries threatened vaccination campaigns, but days of ceasefire for immunization were observed by the warring parties every year, demonstrating once again the social will generated by the goal. For example, in Peru, during the control of the last focus of infection, around 2 million households were visited and nearly 2 million children were vaccinated in the course of one week without any disruption. The less than optimal efficacy and heat stability of OPV was overcome, both by strict cold chain control and by the rapid distribution and use of the vaccine during national immunization days and mop-up operations.

The coalition

This enormous undertaking would not have been possible without a coalition to generate the financial and human resources needed to achieve the goal. Most importantly, the national governments themselves and their thousands of health workers who worked tirelessly under often difficult conditions were the driving force that made the effort successful. To support their work, several agencies backed PAHO in a coordinated effort which became known as the Interagency Coordinating Committee, mobilizing resources to complement those provided by the countries themselves. Between 1987 and 1991, some US$ 110 million were contributed by PAHO, the United States Agency for International Development (USAID), the United Nations Children Fund (UNICEF), Rotary International, the Interamerican Development Bank (IDB) and the Canadian Public Health Association (CPHA). Other nongovernmental organizations both national and international participated on a country-by-country basis. Most importantly, the governments themselves contributed over US$440 million (80%) in a demonstration of their commitment to the health and well-being of their children.

The lessons learned

The effort demonstrated a sound strategy to eradicate poliomyelitis worldwide. Following the successful results achieved in the Americas, the World Health Assembly in 1988 set the goal of global poliomyelitis eradication by the year 2000. The strategies that worked so well in the Americas are now being applied elsewhere. The success has also demonstrated that results can be achieved when there is a specific and measurable objective and sufficient and well-managed resources. The participation of communities was an essential element for the success of the initiative.

The overall immunization programme greatly benefited from the effort. By the end of 1993, immunization coverage for the other vaccines included in most national immunization programmes – DPT, BCG, measles – had reached an all-time high in the history of the Americas. The AFP surveillance system is now used for the surveillance of other communicable diseases, such as measles and neonatal tetanus. Recent field research indicates that the efforts to eradicate poliomyelitis from the Americas have had a very important positive impact on the overall strengthening of the health services.

Finally, this achievement has demonstrated the impact that vaccines can have when properly utilized and the benefits that mankind can expect with the advent of new and improved vaccines which the technological advances of the last decades will certainly put at the disposal of health policy-makers in the years to come. ■

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The last case of polio in the Americas

Luis Fermin Tenorio Cortez (see back cover of this issue) is now five years old and lives in a small town in Peru called Pichinaki, about 400 km east of Lima. When he was two years old, on 23 August 1991, he woke up suffering from a fever and muscle pains, followed by weakness in both legs although his left leg was more affected. He could not walk and attempts by local health services to treat him had no effect. In early September, he was referred to San Juan de Dios Hospital in Lima, the most sought-after hospital in Peru for children with walking difficulties and one of the weekly reporting sites for the national polio eradication programme.

The attending physician suspected poliomyelitis and called the Ministry of Health, where the epidemiologist in charge declared it a "probable" case of polio. Local health authorities in the district of Pichinaki began an immediate vaccination campaign.

In November, the laboratory confirmed that the paralysis was due to wild poliovirus type 1. Luis Fermin's case was a rallying cry for everyone to defeat the wild poliovirus in Peru, which then launched the largest "mop-up" vaccination drive in the Americas. Health workers and volunteers visited two million homes and immunized over two million children in a single week. The boy proved to be the last case of polio not only in Peru but in the whole of the Americas.

After rehabilitation, Luis Fermin now plays soccer with his friends despite a noticeable limp in his left leg. While it is regrettable that he contracted polio, he will grow up knowing that he helped in the eradication effort by inciting all of Peru's health workers to conquer this damaging disease once and for all.

Tracking the virus

Barbara Hull

Each child is assessed for acute flaccid paralysis.

A network of virology laboratories has been established by WHO to undertake the task of virus surveillance – isolating and identifying the poliovirus to determine where eradication activities must be stepped up.

As the global incidence of poliomyelitis cases declines and countries become polio-free, increasingly sophisticated viral detective work is being developed to pinpoint not only the type of poliovirus responsible for an outbreak, but also its precise geographical origin and relationship to other strains of the virus. Eradication of the disease entails eradicating the virus which causes it. Poliovirus types 1, 2 and 3 are a closely related group of small ribonucleic acid (RNA) viruses, with the ability to invade and replicate in the motor neurones of the central nervous system.

The natural history of poliovirus indicates that eradication is possible. Under normal circumstances, man is the only host. There are no animal or insect reservoirs which can harbour the virus, and therefore the prevention of human-to-human transmission will result in its elimination. Survival in the environment is possible, but is limited to a few days in the presence of high temperatures and bacterial contamination. Unlike many other pathogenic organisms, infection does not result in a long-term carrier state but in elimination of the virus from the body and the development of protective life-long immunity. From a detection point of view, a key problem is the fact that less than one per cent of infected children develop paralysis – the most obvious symptom of polio. A further 10% develop mild, non-specific symptoms while the vast majority of infections are symptom-free. A further complication is the fact that polio-like paralysis may be caused by other infectious agents (including other enteroviruses), by neurological disorders or even by toxic substances and trauma.

Where is the wild virus?

It was clear that clinical criteria alone were not enough to monitor the occurrence and disappearance of this disease. How would we know which child with acute flaccid paralysis (AFP) really had polio? Conversely, how do we know that poliovirus is not circulating silently among susceptible individuals and even among immune children and adults, showing no signs but ready to strike? When high immunization coverage and mass vaccinations reduce virus circulation to a few focal areas, how can these be detected? Where is the wild virus?

A network of virology laboratories has been established by WHO to undertake this task of virus surveillance. Their critical function is the accurate and reliable isolation and identification of poliovirus in clinical specimens using standardized techniques and reagents.

The network is organized on a three-tiered system, with more than 60 national laboratories working in close coordination with epidemiologists who investigate AFP cases. These are supported by 15 regional reference laboratories, which supply reagents, provide on-the-bench training, and perform more sophisticated techniques. Five specialized laboratories provide global support for research, production of specific reagents, and development of training materials. Not all countries have the necessary facilities, and arrangements must be made to transport specimens, under refrigeration, to the nearest competent laboratory. The competence of the WHO network laboratories is assured by constant training, provision of high quality antisera and sensitive cell cultures, and annual proficiency testing.

The surveillance system for polio relies on prompt reporting by health workers in clinics and hospitals of all

Testing stool specimens.

children with AFP. These are examined by paediatricians and epidemiologists, and specimens – stool samples – are collected for laboratory investigation. In countries with few cases, specimens are also collected from healthy children who are close contacts.

The isolation and typing of a poliovirus does not end the laboratory investigation. Oral poliovaccine is a live attenuated mixture of the three types, which multiply in the gut and are excreted for several weeks after vaccination. Vaccine virus grows readily in cell culture, and is initially indistinguishable from its virulent, "wild" relative, so special tests have been developed to differentiate wild from vaccine-derived strains.

As the number of confirmed cases declines and several countries become polio-free, fresh questions arise. Have the indigenous strains of wild polio really disappeared? If a case or an outbreak occurs after a period of months or years, was this virus silently circulating all this time, representing a failure of the virus surveillance system, or has it been recently reintroduced from another country?

Research designed to answer these questions has been spearheaded by a team at the Centers for Disease Control in Atlanta, USA, who are leaders in the field of "molecular epidemiology" – viral detective work which is based on observed small changes in the RNA over time. Studies on the genetic material of a large number of strains have shown that, as the virus is transmitted from person to person, mutations occur at a rate of approximately 2% of a selected portion of the genome each year.

Examining cell cultures.

These changes do not affect the susceptibility of the virus to antibody derived from vaccination or natural infection, but provide a useful tool for determining the relationship between viruses of the same type. High conformity in the sequence of the building blocks of the genetic material of two wild viruses indicates that very few transmission cycles have occurred from their common ancestor. They are therefore considered as members of the same genomic family. Larger differences indicate a more distant diversion in the past, and independent lines of transmission. Differences of greater than 10% are taken to indicate different "genotypes" or families of viruses.

Analysis of strains from many countries and regions has revealed "homelands" of various genotypes – limited geographical areas within which they circulate for a given time. Maps have been constructed showing the global distribution of the major genotypes.

The programmatic implications of molecular epidemiology are far-reaching. Eradication activities can be directed at eliminating genotypes from their homelands even when they extend across national and regional borders. These coordinated surveillance and immunization strategies are being undertaken in several groups of countries. The need for intensified activities becomes apparent in highly endemic countries which are sources of virus. Developed countries and donor agencies are being encouraged to provide technical and financial assistance to those countries.

Until the poliovirus is eradicated from every part of the world, all countries are at risk and will have to maintain constant epidemiological vigilance and viral surveillance. ■

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Rotary's PolioPlus

Cary Silver

Rotarian Eddie Obianwu has travelled thousands of miles and recruited thousands of volunteers to help deliver poliomyelitis vaccine to remote villages in Nigeria. For the last four years, he has devoted himself almost night and day to the PolioPlus Programme of Rotary International. He has vowed that no child should ever be crippled by this disease, as long as the technology exists to prevent it.

Eddie is part of a massive force of more than one million Rotarians worldwide who are pursuing the same goal. Their strategies are as diverse as their cultures and countries. But they all have the same dream: to wipe out polio. In India, 36 000 Rotarians and their families help to staff immunization posts and health centres. In the United States, Rotarians fight complacency with the public service message, "Be Wise, Immunize." In Zambia, they provide polio vaccine to refugees from Mozambique. In the Philippines, they conduct house-to-house surveys to determine which children have not been immunized.

To date, Rotary International has allocated more than US$ 181 million for PolioPlus projects in 98 nations to protect some 500 million children.

Rotary International is an organization of more than 1.2 million business and professional men and women in 26 000 clubs worldwide which provide humanitarian service, encourage high ethical standards, and help build goodwill and peace in the world. The organization is non-political and non-sectarian, with a motto of "Service Above Self". Rotarians believe that concerned and involved volunteers can achieve seeming miracles where governments traditionally fail.

A coalition for health

In 1985, Rotary became the first international private organization to make a major commitment to child immunization in developing countries. Through a programme called PolioPlus, it pledged to provide oral polio vaccine for newborn babies for up to five consecutive years to any country that requested assistance. The PolioPlus campaign had as its first goal to raise US$ 120 million to fight polio. Rotarians stunned the world by raising more than $240 million – one of the largest fundraising efforts of its kind in history. To date, the Rotary Foundation of Rotary International (which administers the funds) has allocated more than $181 million for PolioPlus projects in 98 nations to protect some 500 million children.

Carlos Canseco, who served as Rotary's president when the programme was officially launched in 1984, called PolioPlus "a gift Rotary has given to the world. Not only the gift of vaccine, but the gift of our vision and energy." Rotarians have donated their time, talents, and money. But their greatest contribution may be their ability to recruit and motivate volunteers from a wide cross-section of the community.

Rotary realized that it could pursue its goal of polio eradication only as part of a global coalition, alongside WHO, UNICEF, the Pan American Health Organization, the US Centers for Disease Control and Prevention, the Task Force for Child Survival and Development, and others. These groups have combined their expertise and resources to attack polio from all sides.

The PolioPlus Programme of Rotary International is playing a major role in extending polio vaccination coverage to all children.

Polio-free status?

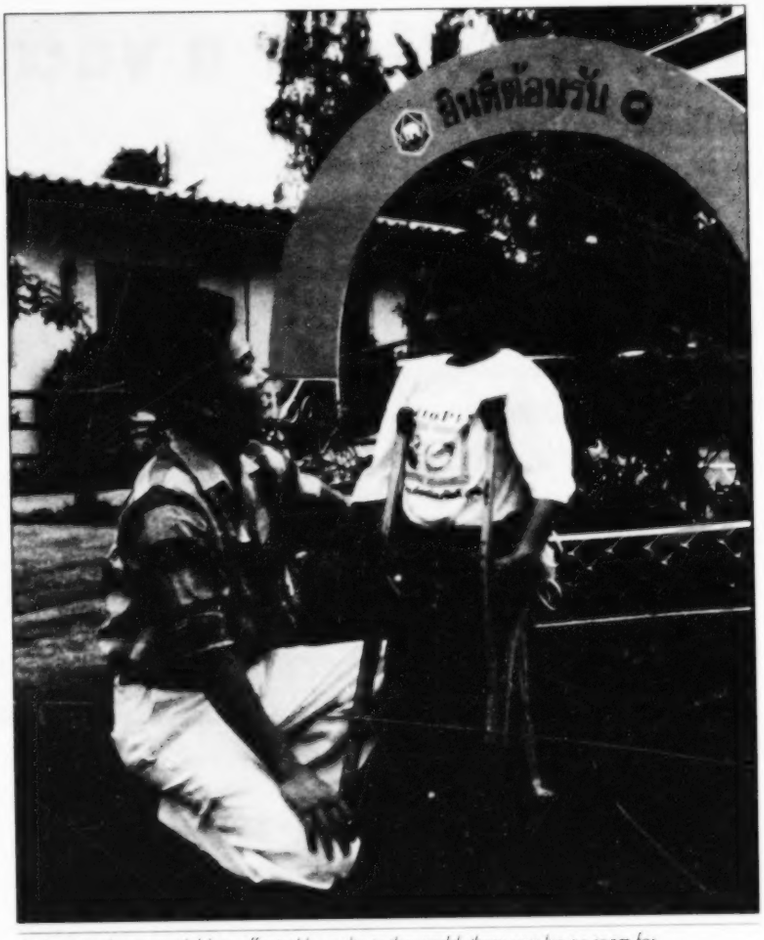
Perhaps Rotary's greatest success has been in the Americas, which has not reported a single case of indigenous poliomyelitis since August 1991.

In Peru – site of the last reported polio case in the Americas – Rotarians have had to cope with guerrilla warfare, economic problems and a cholera epidemic. In 1992, Peruvian members helped the government to carry out a massive "mop-up" effort to immunize two million children – the largest ever conducted in Latin America. While government vehicles were attacked, the Rotarians were able to enter areas controlled by the Shining Path guerrillas to deliver vaccine.

In Africa, the campaigners confront overwhelming obstacles on a daily basis – civil war, political instability, declining economies and poor infrastructure. In Liberia, Rotarians such as Gus Simpson have demonstrated great courage in a country plunged into civil war. Simpson (whose house was burned down by rebels) and fellow Rotarians have continued to deliver vaccine, even in rebel-held areas. When asked why he hasn't given up on PolioPlus, he responds: "My attitude is that you shouldn't complain, but make things better."

The campaign is also actively immunizing children in the developed nations. US Rotarians, who once focused only on fundraising, have jump-started efforts to boost the low coverage levels in their own country. "It is crucial that we boost immunization rates in the United States, because polio can still be reintroduced from other countries," warns Charles C. Keller, a former Rotary president. One of the latest regions to benefit from PolioPlus is Eastern Europe, where new Rotary clubs are being founded. In 1991, Romania became the first country in Eastern Europe to receive a PolioPlus grant.

Despite the significant progress made, PolioPlus faces new challenges in the years ahead. The main focus of Rotarians today is on three areas: support to national immunization days, particularly through social mobilization; surveillance; and advocacy. As countries move closer to the day they are certified as "polio free", it becomes even more difficult to achieve that last degree of coverage. Indeed the greatest threat at this point may be complacency. "We must stay motivated," says 1994-95 Rotary International President Bill Huntley of England. "We must guard against complacency until every country is certified as polio-free. I am confident that we will celebrate that day before Rotary's 100th birthday in 2005."



So long as there are children affected by polio in the world, there can be no room for complacency.

In 1992, Rotary provided a grant of $250 000 to WHO to help develop a heat-stable vaccine. In turn, WHO has recognized Rotary's historic achievements by presenting the organization with its highest honour, the "Health for All" gold medal.

"It will be a proud day when we can celebrate the end of polio – and to know that we played a part," says Eddie Obianwu of Nigeria. "It will be our gift to future generations. And for me personally, it will be a dream fulfilled." ■

Ms Cary Silver is Assistant Editor of The Rotarian, official magazine of Rotary International. She has travelled to Thailand, Indonesia, Nigeria, Mexico and Bolivia as a photo-journalist to cover Rotary's PolioPlus Programme. Her address is 1560 Sherman Avenue, Evanston, IL 60201-3968, USA.

The quest for a vaccine

Fred Robbins

A century ago, "infantile paralysis" had a low mortality rate and rarely caused paralysis. Then the character of poliomyelitis changed. Faced by a much more crippling disease, medical science urgently needed to discover safe and effective vaccines.

The key to polio eradication is ensuring that a safe and effective vaccine reaches every child in the world.

Forty years have elapsed since the field trial of the killed poliomyelitis vaccine (KPV), developed by Jonas Salk, resulted in the first safe and effective vaccine becoming available for general use. Some years later the live attenuated vaccine of Albert Sabin (OPV) became available. In the space of 40 years, poliomyelitis has largely disappeared from the industrialized world and, on 29 September1994, eradication or "the interruption of transmission" of polio from the Americas was certified.

The polio viruses have probably been parasites of man for thousands of years. Until the latter part of the 19th century, polio was endemic throughout the world. Most people became infected early in life but only 1 in 100 or fewer of infected persons developed paralysis. Thus it was truly "infantile paralysis", with a low mortality rate and residual paralysis largely limited to very young children. The non-paralytic polio virus infection resulted in life-long immunity to the disease so that most of the population were immune from an early age.

The disease began to change its character in the late 19th century in the industrialized countries. It occurred in epidemics in the summer and early autumn in the northern hemisphere. The first major epidemic was described by Medin in Stockholm in 1887. Epidemics began to occur throughout the industrialized world and the age incidence of paralytic disease steadily increased, resulting in a more severe disease and more patients with involvement of the muscles of respiration. These were the patients who required care in a respirator or "iron lung" and among whom the mortality rate was highest. Many of the respirator patients who survived were severely crippled and some required respiratory assistance for the remainder of their lives.

In 1909, Landsteiner and Popper were able to transmit polio to monkeys by inoculating directly into the brain a suspension of central nervous system tissue from a fatal poliomyelitis patient. The infectious agent was later shown to be a small virus which is one of the enteroviruses, and the disease proved to be primarily an infection of the gastrointestinal tract. Virus was present for a few days in the patient's throat and for as long as several weeks in the faeces. Two groups of United States investigators in 1936 prepared vaccines from the brain and spinal cord of infected monkeys which were treated to inactivate the virus. Hundreds of subjects were vacci-nated but some developed paralysis, presumed to be caused by virus that had escaped inactivation. These experiments were promptly terminated and further progress in polio prophylaxis awaited technical advances.

A safe vaccine at last

With the report in 1949 from Enders' laboratory at the Boston Children's

Hospital that polio virus could be grown in cultures of a variety of non-nervous tissues, the means were at hand to produce safe and effective vaccines. It was five years later that the Salk killed vaccine, prepared from virus grown in monkey kidney cell cultures and inactivated with formalin, became available. The 1954 field trial, which showed it to be safe and effective, involved almost two million children in Canada, Finland and the USA.

With the availability of an effective vaccine, many countries and communities embarked upon vaccination campaigns with encouraging results. Indeed, in Sweden, where a high polio vaccination rate was rapidly achieved, paralytic polio disappeared within a few years and the virus could no longer be detected in the environment. However, for much of the world the KPV was not the ideal product since it required needles and syringes and was relatively expensive.

In 1960, the Sabin live attenuated vaccine (OPV) – delivered orally – became available and was adopted as the vaccine of choice by the USA and many other countries because of its ease of administration, low cost, the multiplier effect of transmission from vaccinees to their unvaccinated contacts, the greater effect upon the susceptibility to reinfection and the lower cost. It did however, have two disadvantages. The vaccine is sensitive to inactivation by heat and therefore must be refrigerated during transport and storage, which can be a serious problem in many tropical and less developed countries. Also it was discovered that a rare recipient or contact developed paralysis due to the vaccine virus. This was a small but definite price to be paid for a very great benefit to society. Thus, by 1960 two effective and relatively safe vaccines were available. Within the next 10 to 20 years, polio was eliminated from most industrialized countries, but persisted as an endemic disease in the less developed countries where most of the world's population live.

In 1985, the Pan American Health Organization (PAHO) announced the goal of eradicating polio from the Americas. The polio eradication programme was coordinated by PAHO but a great deal of effort to organize and carry out the programme was required within each country. There had to be strong political support since a significant part of the cost was borne locally in spite of financial support from many partners, including Rotary International. The Rotary Clubs provided substantial financial assistance, and their members volunteered their help.

The programme for eradication of polio from the Americas was extraordinarily successful. The last case of polio due to wild virus in the Americas occurred in Peru in August 1991. A special commission in each country reviewed their country's data and in August 1994 all reported that they were satisfied that the virus had been eradicated from their country. On 29 September, at PAHO headquarters in Washington DC, the International Commission to Certify Eradication of Polio from the Americas concluded that wild polio virus transmission had been interrupted in the Americas, which means that eradication has been achieved. The Americas have shown what can be done. The rest of the world must follow suit so that we can achieve the WHO goal of a polio-free world by the year 2000. ■

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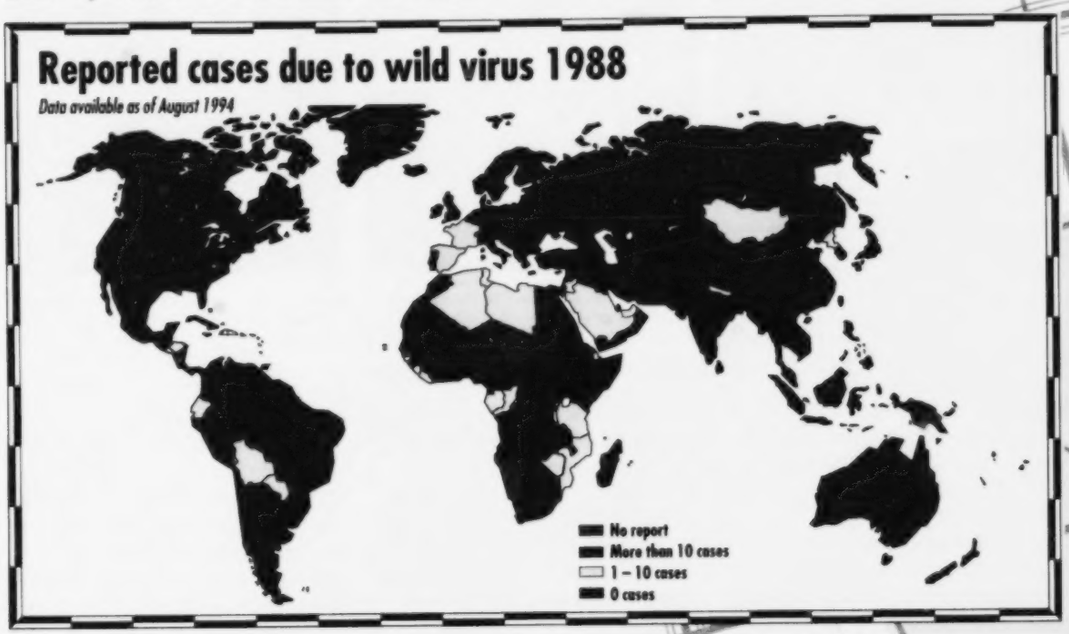
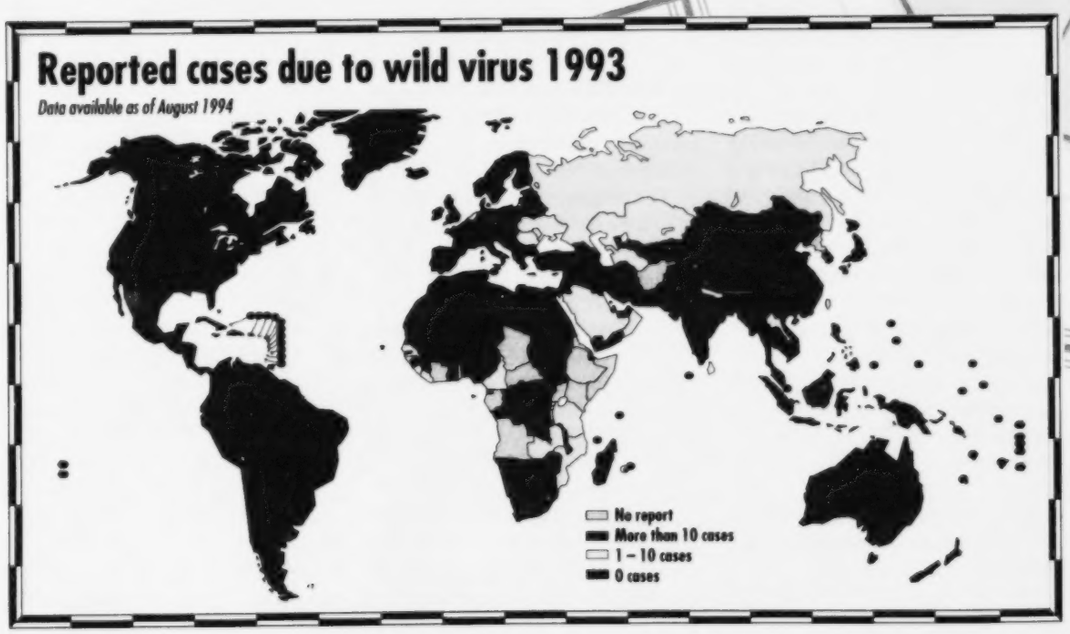
Towards a wo

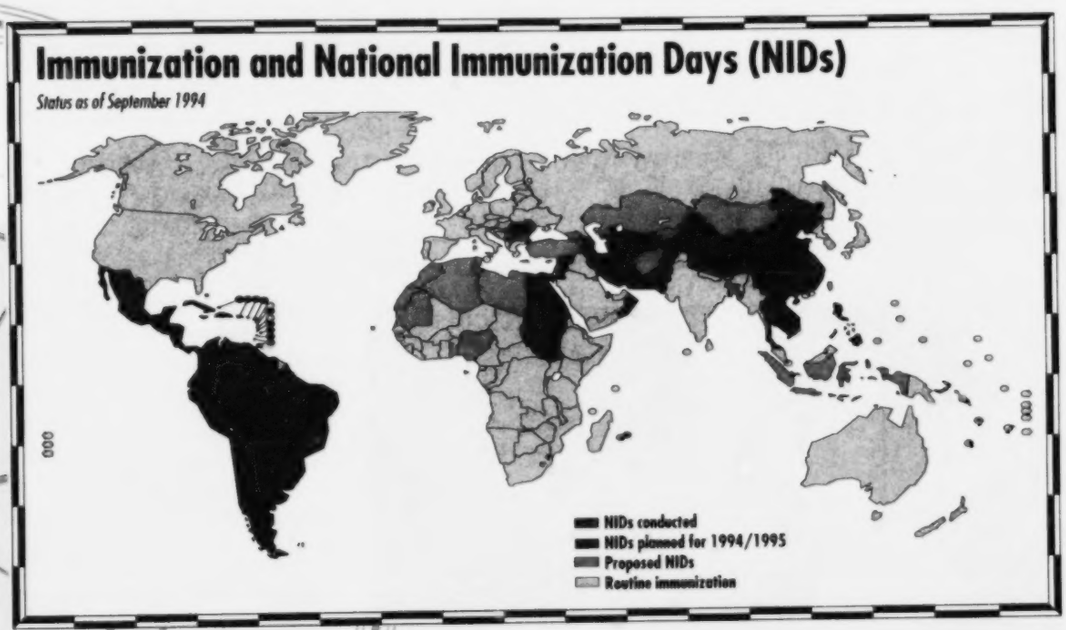
In five years, the world has changed colours, as seen in the two maps showing the number of cases of poliomyelitis due to a wild virus reported by countries. The 1988 map is heavily stained in red, as many countries reported more than 10 cases, and green areas – 0 polio cases – were still scarce. For 1993, the countries of the former Soviet Union are almost all shown in yellow – which means that they reported less than 10 polio cases. The whole of the American continent and several countries in each of the other continents are now shown in green. The world is marching towards polio eradication.

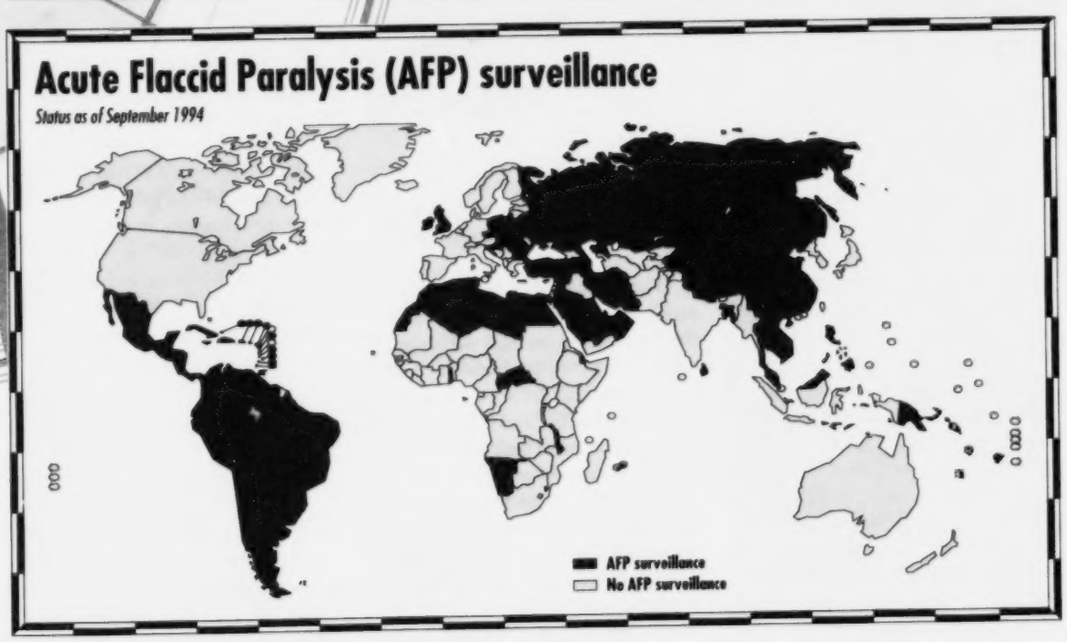




l without polio

The two other maps show what countries are doing. All of them are carrying out routine immunization, and many intensify their efforts by organizing National Immunization Days (NIDs). Furthermore, almost half of the world's population is covered by surveillance of acute flaccid paralysis, which may – or may not – result from a polio infection. Stools of children under 15 with flaccid paralysis are examined in search of the wild polio virus. If no virus is found, eradication can be confirmed. The article "Target 2000" on pages 6-7 gives a fuller account of these activities and of the progress of polio eradication worldwide. ■





Supplying the vaccine

David Halliday & Julie Milstien

To ensure that vaccines are available for both routine and supplemental needs, WHO and UNICEF are exploring new procurement strategies, new suppliers, better forecasting and planning, and improvements to the vaccine.

Large shipments of vaccine arriving at a distribution centre in Africa

Since the Expanded Programme on Immunization began in 1974, oral poliomyelitis vaccine (OPV) has been given to millions of children around the world. UNICEF's vast supply system has procured and delivered over 2500 million doses of OPV to more than 100 developing countries in the Americas, Africa, Asia, and the Middle East, helping to immunize over 100 million children each year. Besides supplying the vaccine, UNICEF has worked with WHO to ensure that vaccine arrives safely at the health centre. The vaccine "cold chain" is a logistics system to keep the vaccine cold from the moment it is bottled until it is finally given to a child.

The UNICEF Supply Division and WHO have standardized both the vaccine and the cold chain equipment specifications. Because of this coordination, all OPV purchased through UNICEF is of guaranteed quality and can be maintained in tested, approved equipment. The standardized dosage and model wording for leaflets and labels have also made possible the interchangeable use of vaccine from different manufacturers.

The polio eradication goal calls for huge amounts of OPV to be delivered through routine and supplemental strategies. Routine strategies use OPV in a predictable fashion throughout the year. National immunization days are regarded as a supplemental strategy and are intended to deliver OPV simultaneously over a wide epidemiological area, so it is critical to have large quantities of vaccine available at a particular moment. Since national immunization days might require tens of millions of doses of OPV at a time – China recently delivered 83 million doses of OPV in one day – the need for advance planning is clear. To ensure that vaccines are available for both routine and supplemental needs, WHO and UNICEF are exploring new procurement strategies, new suppliers, better forecasting and planning, and improvements to the vaccine.

Procurement strategies

To ensure a steady vaccine supply, UNICEF periodically evaluates and modifies its procurement strategies. For example, to meet a large increase in demand for vaccines after 1985, UNICEF lengthened to two years its period for receiving price tenders so as to enable manufacturers to plan better for these volumes. The two-year tendering process provided producers with a reasonable assurance of demand during the next two to four years.

UNICEF is currently discussing new procurement strategies with its suppliers. For example, a five-year tender period may encourage manufacturers to invest in additional capacity or to lower their prices.

New suppliers

Although much of the world's supply

From the producer's premises to the vaccination posts, polio vaccine has to be transported under refrigerated conditions.

of OPV is purchased from five major suppliers located in the industrialized world, local production of vaccines meets the need in several large developing countries. For OPV, about half of the vaccine used is manufactured within the country of use. But many countries are not making enough vaccine locally to meet their needs, and the supply must be supplemented in some other way. One method of doing this is called production sharing: the importation of bulk vaccine which is mixed and filled into vials in the country. Countries such as India, Egypt, Pakistan and Brazil thus use their local resources and industry while still optimizing capacity and quality. Working with UNICEF and WHO, countries and the industrial producers of bulk OPV have entered into contracts which facilitate this process.

Forecasting and planning

When the EPI began, the emphasis was on getting as much vaccine as possible to the children who needed it. Strategies for ordering and delivering vaccines were not focused on economy. However, as the demand increased, it became clear that better planning was needed. Not only must UNICEF pay more for vaccines bought at the last minute, but inaccurate forecasts tend to damage the relationship and confidence existing between UNICEF and the manufacturers. WHO and UNICEF are developing new tools to assist countries to make accurate forecasts. In future, countries will be rewarded for better planning.

Vaccine vial indicators

Vaccine wastage – the amount of vaccine which is delivered to the immunization centre but is unused and thrown away at the end of the day – has become a serious concern as greater attention is focused on vaccine supply. Traditionally, discarding unused vaccine at the end of the session was recommended to ensure that the fragile vaccine was not compromised by exposure to too much heat. Vaccine wastage can be as high as 50% of the supply in some circumstances. The search is continuing for vaccine which will retain its potency at high temperature for a longer period of time. This increased stability, combined with the use of new time-temperature indicators, will let the health worker know whether vaccine still left in the vaccine vial has received an excessive exposure to heat.

Paying for the vaccine

While OPV is not very expensive – about US$ 0.08 a dose at current prices – other factors have an impact on the price. More than 20% of the cost of the delivered vaccine is the cost of air freight to get the vaccine from the manufacturer to the starting-point of the country's cold chain. Providing two extra doses every year for each child under five years of age adds considerably to the immunization budget available to a country. Many countries have found it too expensive to launch polio eradication activities.

Rotary International has been a major donor, with UNICEF, of polio vaccine for the eradication initiative, and many bilateral donors have also been involved in vaccine purchase. But donations alone are not the answer.

An important change in the polio eradication effort has been that governments are beginning to plan more carefully and take more responsibility for funding their own vaccine needs, rather than relying on donors. Governments are developing stronger, more sustainable systems for vaccine supply, procurement and production which will assure the availability of high quality vaccine. These efforts will increase the governments' ability to obtain not only OPV but all vaccines, even long after polio has disappeared as a global threat. ■

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Supplying every individual child with the vaccine is the key to polio eradication.

Rehabilitating children with polio

Ann Goerdt

Without proper braces and skilled rehabilitation, many victims of polio would not be able to walk.

Health workers should actively encourage all families with a child who has polio to ensure that the child has the same experiences as other children in family life, play and school.

When the poliomyelitis eradication programme was initiated in 1988, an estimated 10 million people had some degree of disability caused by the disease. It was anticipated that between the years 1988 and 2000 another two million children would be affected by polio. So countries were encouraged to strengthen their rehabilitation services at the same time as they increased their efforts to eradicate polio.

We are now at the half-way point in the eradication programme. All countries have established procedures for the early and thorough detection of polio. Yet most countries where polio is still present have not expanded their rehabilitation services for recently detected children or those who had polio some time ago.

To ensure the normal development and social integration of children who have had polio, it is necessary to prevent deformities, provide means for mobility, include the children in local schools, and integrate them along with all other children in the activities of the family and community. When these children become adults, they should have the same opportunities as others to marry, to contribute to the support of their families, and to take part in all the activities of their communities.

The role of health services

The health services are usually responsible for the rehabilitation process, which consists of prevention of deformities, promotion of normal growth and development in the young child, and provision of the necessary equipment for mobility. Families must learn the methods for preventing deformities, which can be taught by health care workers who have the appropriate training, or by rehabilitation workers if they are available. Many families automatically promote the normal development of a child with paralysis, particularly if the paralysis affects only one limb. However, health workers should actively encourage all families with a child who has polio to promote the development of the child's movement to the extent possible, and to ensure that the child has the same experiences as other children in family life, play and school.

The greatest obstacle to the rehabilitation process in many countries

Learning how to walk after a severe attack of polio

has been providing leg braces to children who need them for walking, since trained personnel must be available to make the appliances. Orthopaedic workshops with appropriate equipment need to be established in different parts of the country so that the services are accessible, and the materials for the appliances must be provided to the workshops on a regular basis. Many developing countries have not had the necessary resources.

Many older children and adults with polio could also walk if they were provided with braces, although they may require surgical procedures to correct deformities in the legs so that they can be fitted correctly. This service is also unavailable to a majority of people with deformities due to polio.

When government resources are too limited to provide appliances for mobility or surgical corrections for deformities, nongovernmental organizations (NGOs) are encouraged to promote and support the provision of these services. This is already being done in some countries where NGOs have been active in the polio eradication programme, and their role in promoting rehabilitation could also be strengthened.

Long-term rehabilitation

By the year 2000, children will no longer become paralysed by the poliovirus. However, the need for appliances for those who were affected by polio prior to its eradication will continue for several more decades. Between 1994 and 2000, countries should increase their efforts to provide rehabilitation services for those children who get polio, as well as for those who are already paralysed. Planning of services should also ensure that the repair and replacement of appliances will be available throughout the lifetime of people affected by polio.

The health sector is the one responsible for identifying new cases of polio, and it is the health sector that provides the initial rehabilitation services. As soon as a child with polio is identified, these services should go into action. But the comprehensive rehabilitation of people with polio requires the collaboration of health, education and social services. The health sector can take the lead in stimulating other sectors to increase their efforts so as to ensure the full participation of people with polio in all aspects of family and community life, but other government sectors and NGOs must also become more active.

An agreement signed recently between the International Olympic Committee and the United Nations Children Fund (UNICEF) includes the goal of "No More Polio" as a priority. This agreement between a committee which emphasizes excellence in sports and an organization concerned with children's health focuses attention not only on the eradication of polio, but also on the physical, mental and social well-being of children with polio. The goal of "no more polio" should be interpreted as insisting that there should be no new cases of polio and no more deformities or severe limitations for those who got polio before its eradication. ■

Dr Ann Goerdt is a Scientist with the Rehabilitation Unit, World Health Organization, 1211 Geneva 27, Switzerland.

Soon no further cases of polio will occur, but the victims of past outbreaks will still need to be cared for over many years.

WHO's Guidelines for the prevention of deformities in polio provides information on preventing deformities in young children recently affected by polio. It shows how health workers can teach families to move a child's limbs, to position the child during the day and at night, and to make temporary splints to maintain appropriate positions for limbs with paralysed muscles.

Guidelines for training personnel in developing countries for prosthetic and orthotic services indicates how personnel can be trained to international standards for making lower limb braces. Personnel trained in this manner could contribute greatly to the supply of braces in countries with the highest rates of polio. These two documents are available free of charge from the Rehabilitation Unit, World Health Organization, 1211 Geneva 27, Switzerland.

Basic surgical procedures which can be performed by non-specialist medical officers are described in *Rehabilitation surgery for deformities due to poliomyelitis: techniques for the district hospital*. District hospitals are likely to provide more accessible services for those who require surgery prior to being fitted with braces. This publication is available for Sw.fr. 25.00, or Sw.fr. 17.50 in developing countries, from Distribution and Sales, World Health Organization, 1211 Geneva 27, Switzerland.

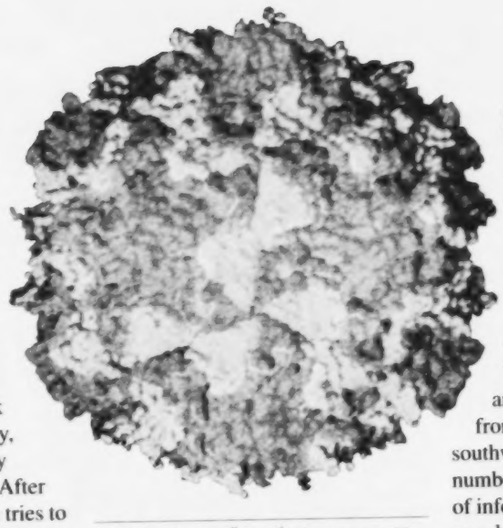
Paying the price for one's beliefs

Paul Oostvogel

One day in September 1992, a 14-year-old boy cycles to his secondary school in Rotterdam, some 25 km from his home village of Streefkerk. The next day, while cycling, his back starts aching and a throbbing headache begins. Despite increasing pain he cycles back to Streefkerk. On the third day, his legs and back hurt so badly that he cannot attend school. After the pains have disappeared he tries to get out of bed at the request of the family doctor, but he cannot stand: his legs are too weak.

The boy is immediately referred to the neurology department of the nearest regional hospital. As he belongs to a community which refuses vaccination on religious grounds, the suspected diagnosis is clear: poliomyelitis. The neurologist notifies his clinical diagnosis immediately to the regional and national health authorities. The media hear of it and present it on radio and television as a major item. Headlines appear in the national press even before the laboratory has confirmed the suspected case, but specimens from both the patient and his 12 family members show the presence of wild poliovirus type 3. The single dose of vaccine virus type1 which the boy had at the age of two months, during a previous outbreak in 1978, only protected him against type1 and not against type 3.

Municipal public health services offered mass vaccination to try to stop the outbreak, and the enormous demand for vaccines from the general public caused chaotic situations in Rotterdam. Within two weeks a second case, in a 23-year-old man from the same region, confirms that the outbreak is a serious threat to this community, after 14 years without any case. At its peak in the middle of November, clinicians reported ten cases in one week. The final count was 71 victims within five months, two of whom died.



The polio virus is still a reality in some countries. Nobody can afford to relax their vigilance.

Several communities in the Netherlands have long refused vaccinations of all kinds on the grounds that they are "against the will of God". As this article and the following one show, young people paid heavily for not receiving their full protection against poliomyelitis.

Vaccine-refusing groups

Since the introduction of inactivated polio vaccine (Salk) in the National Programme in 1957, the first seven localized and the last two nationwide outbreaks occurred within vaccine-refusing communities. They have their own churches and schools and live in clusters from the northeast to the southwest of the Netherlands. The number of susceptible people at risk of infection with poliovirus is continuously increasing. Because of the long periods between epidemics, the classical pattern of infantile paralysis no longer applies, and the mean age of victims shows a striking increase, changing from 1-4 years in 1961 to 15-19 years in 1992. This fact reflects the virtual absence of virus circulating in the Netherlands. This change in average age is not contradicted by the fact that the youngest victim of the 1992 outbreak was only 10 days old and four cases were aged under one month. In earlier days these infants would have been protected by antibodies from the mother.

The outbreak caused confusion for several weeks throughout the population. Fear of infection and paralysis, even among the older people who had been immunized, was widespread. People stopped sharing public transport, and soccer matches and other social events scheduled to take place near places like Streefkerk were cancelled.

Once it was seen that cases only occurred among similar unvaccinated communities, confidence in the vaccine was reassured. Discussions then focused on ethical aspects. Why were the excellent vaccines available

A complete course of vaccinations can protect against all types of the virus.

being withheld from young children? Why does the government allow parents to do this? How can future outbreaks be prevented? Members of parliament raised these and other questions. Nevertheless, the option of making immunization obligatory was again rejected. Some of the Dutch reformed churches consider immunization as an act against the will of God. To counter this view, the strategy of the government and the medical council was based on education and information. But even today, immunization coverage in municipalities such as Streefkerk is still as low as 60%, compared with over 97% for the country.

A traditional pattern

Soon after the outbreak began, the National Institute of Public Health and Environmental Protection (RIVM) started trying to trace the virus that was causing the trouble throughout the country. Techniques were developed and tested which may eventually be useful for the global eradication initiative. Proving the presence of the virus and predicting the final course of an outbreak could contribute to greater immunization acceptance. A large population survey finally confirmed that this had been an almost traditional outbreak pattern in the Netherlands. Not only cases but also the spread of the virus was to a large extent restricted to the risk group.

One remarkable finding emerged from a virological analysis of river-water from near Streefkerk, taken some three weeks before notification of the first case. A poliovirus was isolated which appeared to be molecularly identical with the causative virus for the 1992 outbreak. This finding prompted virologists of the RIVM to propose an environmental surveillance plan which would serve as an early warning system for any further circulation of the virus.

In the end, all these investigations probably did not result in the final destruction of poliovirus type 3 in 1992-93. The simple lesson once more is that, in high coverage areas with excellent hygienic conditions, local circumstances may cause pockets of low immunization coverage where polio may strike over and over again. Acceptance of polio vaccine within the high-risk community during the last outbreak was scattered, therefore the immunity prevailing after the outbreak remains uncertain.

More widespread travel throughout the world makes importation of wild virus to the Netherlands increasingly probable, with an ever greater danger of triggering a new outbreak. The wild poliovirus which circulated within the risk community during the last outbreak will protect less than one generation and then only against one type.

Only the eradication of all polioviruses will finally protect all non-immunized people in the world from this fearsome paralytic disease. The Netherlands has faithfully supported the Expanded Programme on Immunization, and fully shares WHO's confidence in attaining the final goal: eradication of all poliovirus. Meanwhile the daily wheelchair taxi from Streefkerk to Rotterdam, which is provided for the boy who was the first victim of the 1992 outbreak, is a good example of help for the disabled in an industrialized, welfare society. At the same time it shows what simple immunization could have prevented. ■

Dr Paul Oostvogel is a medical microbiologist at the Virology Laboratory (WHO Collaborating Centre for Reference and Research on Poliomyelitis), National Institute for Environmental Protection and Public Health (RIVM), P.O. Box 1, 3720BA Bilthoven, Netherlands.

Protected by vaccine, this youngster can enjoy a healthy life without risk of contracting polio.

Courage in adversity

June Goodfield

Polio victims – famous or unknown – have set signal examples of the capacity of the human spirit to triumph over severe physical and psychological disabilities.

Roelofje Mussche, who contracted polio when she was 11, is now a skilled actress with an important message to convey.

The end-game in our battle with poliomyelitis approaches. Yet as we contemplate the future with optimism we should glance back down the corridors of the past and recall the millions of people from all over the world who caught the virus. So many of them suffered paralysis, and either died or lived to battle constantly with twin disabilities: their own physical limitations and the psychological isolation imposed by other people's fear. While anticipating the triumph to come, we should remember them with compassion and salute them for what they have taught us about the enduring strength of the human spirit.

Their roll-call includes the famous (US President Franklyn Delano Roosevelt) and the unknown (22 small boys playing football in Nigeria, all of whom had polio). The Roosevelt family took their summer vacation at Campobello on Canada's eastern rocky shore. FDR, aged 39, arrived at Campobello in 1921 exhausted, but on 10 August, after an active day, he decided he wanted to swim. So he jogged two miles to swim in the icy waters of the Bay of Fundy. Early that evening he felt chilled and went to bed. The next day he had a high fever, and pain in his back and legs. By Friday he couldn't move his legs at all. A famous diagnostician decided that FDR had suffered a blood clot. His prescription – frequent massages; his bill – US$ 600, in those days an enormous amount of money.

Over the next three weeks, FDR's condition became worse. Eventually his devoted wife Eleanor and his friend Louis Howe had to do everything for him: shave him, brush his teeth, administer catheters, massage his legs. Only on 25 August did a Boston specialist correctly diagnose infantile paralysis – polio. For 15 days FDR had been having absolutely the worst treatment. But in reality there was nothing at all anyone could do.

Fundraising

Twelve years later, in March 1933, F. D. Roosevelt, by then severely paralysed, became President of the United States. The following January his first President's Birthday Ball took place, during which impassioned appeals were made for funds to sponsor polio research. Roosevelt's former law partner, Basil O'Connor, founded the National Foundation for Infantile Paralysis and became its first Director. He started the famous "March of Dimes" fundraising campaign, which was committed to finding effective vaccines. So successful was this campaign that, ten years later, when polio had been controlled in the United States, there were still millions of dollars left in the bank.

This particular set of circumstance changed the history of our struggle with polio. But it changed something else too. Eleanor Roosevelt called her husband's triumph over his disability "a blessing in disguise". Certainly he must have possessed both strength and courage to overcome severe physical and psychological disabilities and give just one more example of the capacity of the human spirit to triumph. Certainly the unflagging devotion of his wife played a crucially important role. But, as she wrote: "He had to think out the fundamentals of living and learn the greatest of all lessons – infinite patience and never-ending persistence." During painful years of trial, the handsome, debonair, somewhat frivolous and spoilt young man developed "a new seriousness about himself, and a deeper empathy for other people."

Similar examples continue to the present day. Outbreaks of polio in the Netherlands, for instance, are almost totally confined to people from the various Reformed (Protestant) churches who refuse vaccination on religious grounds. One such outbreak occurred in 1971, during which a child from one of these communities, 11-year-old Roelofje Mussche, developed flu-like symptoms. No paralysis followed and even today she can move her arms and legs. But the nerves and the muscles of her respiratory system were severely affected. The girl spent the next six years in hospital on artificial respiration, and intensive physiotherapy was completely neglected. Had she received exercise she could have walked; now she is confined to a wheelchair.

Theatre offered an escape route

For the first six years after the paralysis Roelofje could not talk at all. She breathes only through a slit in her windpipe and now, when she wants to speak, she plugs it with an ebony stick to allow the air to pass over her vocal chords. Asked what kept her going all those years, she replies it was the theatre. In her wheelchair she was able to watch plays every week, drama releasing her from the prison of her existence.

One day she asked herself: "What am I doing on this side of the footlights? I should be on the other side, participating on the stage". She saw an advertisement seeking a disabled youngster to take part in a documentary film. She replied, auditioned and got the job. Then the documentary was transferred to the stage – as a play specially written for her role. Produced in 1992, *About Living* tells the story of the outbreak in Staphorst. In one scene an academic anthropologist describes what he thinks happened in the village, but Roelofje comes on and shows how outsiders don't really understand the situation at all. There is also a sequence of her dancing, supported by a Dutch dancer, in an extraordinarily moving and beautiful choreographed routine. Short extracts from this play are regularly repeated on request – at special events ranging from drama groups to congresses on health and polio. She is also working on a drama on euthanasia.

Roelofje's story is something quite unusual in the spectrum of polio victims. Many of them excel in sport or in music, but few have had the courage to take their disability quite literally on the stage, to full public exposure. ■

Many young handicapped people excel in sports.

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No pain, no gain

Juan M. Flavier

Maria, a chubby and carefree two-year-old, was eagerly awaiting her turn for her *patak*, her two drops of oral polio vaccine. She could still remember how peculiar the taste was. This is going to be her fourth *patak*. Her Aunt Loleng was affected by this disease and she goes around with a heavy limp. The thought of last month's scene when some children cried after getting their measles injections made Maria somewhat apprehensive. She could remember her mother's encouragement: "Come on, children. It's all right. It's just like an ant's bite. It's nothing really. Remember, no pain, no gain."

Dr Juan Flavier (second from the left) plays his part in the polio vaccination campaign.

But today her mother assured her and her seven-year-old sister Clara that there would be no pain. Only the women would be given anti-tetanus injections to protect their future newborn babies against neonatal tetanus. Clara was enjoying the fiesta-like atmosphere in the vaccination centre. She explained. "Today is National Immunization Day, like earlier this year and twice last year. It's an event for bringing children to the health centres for vaccinations so they don't get sick. It's our government's effort to rid the country of this disease which causes the limp and other disabilities."

Now Maria eagerly opened her mouth to get her OPV and Vitamin A drops. She heard the midwife tell her mother to bring her back next year on 15 February and 15 March for her next doses. That will be easy to remember because 15 February is her birthday. Then it was her mother's turn to get her anti-tetanus injections. She was actually afraid of injections but today she was trying to be an example. "Come on, mother. Remember, it's just like an ant's bite. Remember, no pain, no gain," Maria and Clara both said with a laugh.

Everyone was involved

It was 16 March 1994, and all over the Philippines in more than 60 000 vaccination centres there were similar lines and activities such as these in the Lanuza Health Centre. Everyone was involved – not only the local health workers and local volunteers, but students, boy scouts and girl scouts, civic organizations like the Rotary and Lions, professional and medical societies, the business sector, nongovernmental organizations, the drug companies, and even movie stars, singers and sports stars, and politicians – from governors to mayors and village councillors.

The message was carried by television and radio stations, in newspapers and magazines, and even in advertisements for foodstuffs and soaps. The major streets and highways all carried streamers announcing the National Immunization Day. Support from international and local agencies came in various forms – manpower and information dissemination, or in the form of streamers and snacks for volunteers, and funds for syringes and vaccines. The most important support came from the frontline health workers. The vaccinations took place where people would usually congregate – in schools, churches, train and bus stations, airports, piers, waiting-rooms, day-care centres, shopping malls, popular restaurants, municipal and city halls and the houses of village captains or councillors. One local city mayor even waylaid all incoming provincial buses in order to persuade the travellers to be immunized.

The response was overwhelming. More than nine million children received OPV; six million received measles vaccines; and nine million women received tetanus toxoid. Armed political dissidents responded by declaring a unilateral ceasefire to enable health workers to reach children in far-flung areas; some rebel groups came down from their mountain hideouts to bring their children for vaccination.

Indeed, everyone was involved. It was one activity that made the Filipinos feel proud, and united. For some, it was the first time they felt they had a government that cared. The long queues were there. The chaos, the sweat, the children's wailing and tears. But everyone was happy and fulfilled. Everyone was unmindful of the pain. Everyone realized the gain. ■

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Egypt tackles polio

Esmat Mansour

Following WHO's resolution to eradicate poliomyelitis worldwide by the year 2000, Egypt's President Hosni Mubarak included in his 1989 declaration of "The Decade for the Protection and Development of the Child" the goal of eradicating polio from the country. Through routine immunization, national campaigns and mopping-up operations, immunization coverage with the oral poliomyelitis vaccine (OPV) reached 93% in 1993. As many as 97% of all infants and children under five years of age have been receiving the first dose of this vaccine. Drop-out rates have been cut down by using birth register data to search for unvaccinated children and extend coverage to them.

Thanks to the efficient cold chain system and improved surveillance, reporting and follow-up, we had only 196 acute flaccid paralysis cases in 1993, a reduction of 71% from the 671 cases reported in 1992. Nine out of Egypt's 27 governorates and 118 of the 206 health districts have been entirely free of new cases of polio for at least one year.

The role of Egyptian women in this success stems from their full integration within all levels of the health care system, with many of them holding top posts in the Ministry of Health, formulating national policies, working with international organizations, and establishing and guiding the development of programmes and strategies. Women are also engaged in immunization research projects and field work, helping to achieve and develop the health targets.

The role of women in Egypt's successful fight against poliomyelitis stems from their full integration within all levels of the health care system. Besides the women doctors and nurses, mothers too deserve a great deal of credit.

In the front line

In fact, women in Egypt represent a considerable proportion of all private and public physicians and health service administrators. As in many other countries, the nursing staff are predominantly women and are therefore engaged in the front-line battle to eradicate polio. The nurse's role here is much broader than the one she plays during clinic hours, and her value to her community and its welfare should not be underestimated.

Not only does she routinely give the polio vaccine, but she is the primary mechanism for dispensing health care information to each child's carers, thus increasing their awareness about the dangers of disease, the importance of vaccination, and any possible side-effects of the vaccine. Therefore she acts as the first defence line against the disease, and her understanding of the early effects of polio and her ability to recognize the disease is essential.

Egyptian society is particularly blessed by a culture and history that produces strong family ties. So ultimately the success of our programme to eradicate polio must also credit the mothers who have listened to the information provided at the official level of health care and who have been convinced that the health of their children is worth all the expense and effort they make.

Nurses can convince mothers of the value of vaccinating their children against polio.

Egypt's Expanded Programme on Immunization is one of the most effective in the world. Reaching our goal of eradicating polio will be a worthy tribute to the hard work contributed by all of us – women and men together – to protect our children. ■

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The role of women

Khadija A. Msambichaka

Almost invariably it is the mothers who take the children to be vaccinated.

Poliomyelitis is a crippling disease. For every person showing symptoms of polio, there are 99 others walking around looking healthy but carrying and spreading the virus. Poor sanitation and hygiene have been contributing to the perpetual circulation of the polio virus in the community.

Fortunately, the disease is preventable through improved sanitation and hygiene and through vaccination with polio vaccine. Since man is the only reservoir of the virus causing the disease, we know that it is possible to eradicate polio, and thus to reduce the burden of communities having to care for the sick and disabled. In most developing countries, it is the women who care for the sick as well as for the disabled in the family. As is the case with other interventions within the family, it is the women who are required to take the initiative in preventing this disease.

In order to eradicate polio by the year 2000, all infants need to be vaccinated routinely and victims of polio must be detected very early so as to prevent further spread of the virus as well as to reduce or prevent future disability. Good sanitation and strict hygiene within the family are clearly essential.

Because of their family caring responsibility in society, women do play an important role in tackling polio, and its eradication will reduce women's potential burden of caring for the sick and disabled. It is nearly always the mothers who take their children for vaccination, and who monitor vaccinations of children below five years of age within their community. They often remind each other to complete their children's immunization. Mothers frequently organize themselves into parents' groups, discussing among other things the prevalence of immunizable diseases in their district.

Most of the health workers providing immunization services and health education are women, and this encourages mothers to monitor the occurrence of any case of sudden lameness in their neighbourhood and to report it immediately to the existing village monitoring system or health post. At home, mothers should encourage and support good hygiene practices in the family by training the children and other members of the household and setting good examples themselves.

Women should be encouraged to work together with community workers or with organizations supporting community-based rehabilitation units in an effort to rehabilitate the disabled and to prevent further disability. Again, rehabilitation will enable mothers to devote more time to other activities aimed at self-development and improvement of the community. ■

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Reaching the hard-to-reach

Stanislava Popova

Hit by unemployment and other problems, the gypsy minority of Bulgaria resented mandatory polio immunizations and neglected them. A sudden outbreak of the disease in 1991 was only stifled by "aggressive outbreak control" with special attention to gypsy children.

Most children can easily be reached through campaigns in the schools. However, some minority groups can still slip through the net.

A small country with 8.5 million people, Bulgaria straddles one of the main roads from Europe to Asia, so the presence of highly mobile ethnic minorities has always created problems with the importation and spread of communicable diseases. The political changes at the end of the 1980s were followed by a substantial decrease in the living standards of the population as a whole, and the gypsy minority in particular. As the first to be severely struck by the wave of unemployment, the gypsies became hostile to any governmental activities, including the mandatory immunizations.

The most dramatic year after the political changes was 1991, when there was a shortage of everything – food, medicines and even soap. In this grave situation and after years of seeing no poliomyelitis cases, there came a sudden outbreak of the disease. Four paralytic cases were reported in gypsy babies. Was it polio? I remembered 1976 when we had an epidemic resembling poliomyelitis but caused by another enterovirus. At that time we could afford large quantities of the cheap Russian polio vaccine and we reimmunized practically the whole population. Now it was not an easy decision but the epidemiologist from the "gypsy capital" was waiting for my answer and I gave it. "We shall not wait for laboratory confirmation. Act as if these are confirmed polio cases. Begin tomorrow. Mobilize paediatricians and immunize all gypsy children up to 7 years of age."

During the next few days single paralytic cases were reported from other neighbouring regions and all were in gypsy children, not fully or not at all immunized against polio. We decided to ask WHO to find a sponsor and supply oral polio vaccine (OPV) for a national immunization or reimmunization campaign aimed at all children up to 15 months and gypsy children up to 7 years of age.

Over in six months

We introduced all the activities recommended by WHO for aggressive outbreak control. There was door-to-door immunization; I personally visited not only the places affected but the high-risk areas as well. The outbreak ended in six months. Experts from WHO headquarters in Geneva and the European Regional Office in Copenhagen visited the country several times and were taken to the affected regions. Over three years have now elapsed and there has not been a single confirmed case of polio in Bulgaria. One of the most important lessons we learnt was that a country with such a big proportion (over 15%) of hard-to-reach inhabitants should not rely on only the traditional immunization services. A national immunization campaign will be launched very shortly which will put special emphasis on hard-to-reach ethnic and social groups. A National Committee has been formed under the patronage of the country's President and we hope this initiative will mark another great step towards polio eradication. ■

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Costs and savings

David M. Salisbury

There can be no progressive winding down of poliomyelitis immunization or surveillance services until global eradication is reached. When that happens, every country will immediately benefit.

In 1971, the Chief Medical Officer, Sir George Godber, wrote to all doctors saying that in recognition of the remarkable progress of the WHO smallpox eradication programme, the risks of introducing smallpox into the United Kingdom were so low that routine vaccination of young children was no longer recommended. This decision was described at the time as an outstanding event in the history of public health. After 130 years of routine vaccination, the first vaccine to be introduced became the first to be stopped. What lessons from the eradication of smallpox could we apply to our expectations for the eradication of polio?

Smallpox immunization was stopped in the UK when the balance between two forces shifted. No longer was the overall benefit to the community from protection against smallpox sufficient when compared with the risk to the individual from vaccination. While there was a likelihood that smallpox could be imported into the UK, routine vaccination was appropriate. Once the WHO smallpox eradication campaign brought those risks of importation down to very low levels, a critical appraisal of the complications from routine vaccination showed that the risks had become hard to justify.

In the 20-year period between 1951 and 1970, over fifteen and a half million vaccinations and revaccinations were carried out. Over the same period, there were 759 cases of generalized vaccinia and encephalomyelitis following immunization and 85 deaths. A further 16 individuals, people not vaccinated themselves but in contact with vaccinated people, died from eczema vaccinatum. Over the same period, there were 131 indigenous cases of variola major with 47 deaths. In 1962, when there were several importations of smallpox resulting in 62 indigenous cases with 24 deaths, 19 people died from complications of vaccination or after contracting the disease through contact with vaccinated people. Once it became clear that WHO was winning the worldwide battle against smallpox, the vaccine risks outweighed those of the disease and the stopping of routine vaccination was announced.

Every child must still be vaccinated against polio until the disease is totally eradicated.

Enormous savings

What have we saved since 1971? At the time of stopping routine vaccination, around two million doses of smallpox vaccine were being purchased each year. Assuming that the same levels of vaccination had continued, the cost until now would have been close to US$ 50 million at 1970's prices! This does not include doctors' fees and other costs incurred. As a result of stopping smallpox vaccination, the savings in health service resources and vaccine-associated morbidity and mortality over the last 23 years have been enormous, in just one country alone.

A young victim of smallpox. Routine vaccination against smallpox could be stopped once world eradication was certified in 1979.

What will the eradication of polio mean? There are some similarities with smallpox eradication, but also some clear differences. Many countries had abandoned smallpox vaccination nearly a decade before global eradication was announced. This is clearly unthinkable for polio immunization. Every country must maintain the highest possible levels of immunization coverage until the last country in the world can prove that it has eradicated polio. Otherwise, the risks of importing wild polio virus into an unimmunized country are simply too high. The consequences would be epidemic poliomyelitis in a susceptible community among the children born since abandonment of routine immunization. There can be no progressive winding down of immunization or surveillance services until global eradication is reached. When that happens, every country will immediately benefit.

The present cost to the Department of Health for polio vaccine for England is over $5 million, money that would be immediately available for other purposes as soon as global eradication of polio is achieved. The costs of providing polio immunization are harder to calculate because doctors are paid for routine childhood immunization, not for each immunization given, but only when they reach certain targets. Thus, if 90% coverage is reached each quarter, the payment is an additional $2700 per annum. To reach these targets, doctors have to show complete immunization of all target children against the main killer diseases of children.

As with smallpox immunization, there are some adverse events associated with polio immunization. There are on average two cases of vaccine-associated poliomyelitis each year, one in a vaccine recipient and one in a contact of a recent vaccine recipient. The former are usually young children, sometimes with immunodeficiency diseases, the latter usually adults who had escaped previous immunization. Some of the vaccine-recipient cases have died and some of the vaccine-associated cases have suffered sufficient paralysis to be eligible for payment under the present UK vaccine damage payment scheme (a single payment of $30 000). When polio immunization stops, there will be no more vaccine-associated cases with their burden of morbidity and mortality.

It is clear that the eradication of smallpox led to very large savings in direct and indirect health service costs. The eradication of polio will be associated with even greater savings in direct costs – vaccine purchase and payments for vaccine administration. Even the figures that have been quoted are underestimates, since they ignore costs such as the work time of nurses, expenditure on vaccine storage and distribution, and the surveillance in place for polio. Humanity will benefit from the eradication of a disease that causes avoidable paralysis and death. Health services in every country will benefit, either by releasing human resources for other activities or by making finances available to support other services or to introduce new vaccines. ■

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ALIVE AND KICKING THANKS TO REHABILITATION! FERMIN TENORIO CORTEZ WAS THE LAST PERSON TO CONTRACT POLIO IN THE WHOLE OF THE AMERICAS.

(READ HIS STORY ON PAGE 9)